145.   De Morgan on Euclid's fourth postulate. *Bulletin of Symbolic Logic.* 20 (2014) 250. (Coauthor: Sriram Nambiar)

► JOHN CORCORAN AND SRIRAM NAMBIAR, *De Morgan on Euclid's fourth postulate.*
Philosophy, University at Buffalo, Buffalo, NY 14260-4150, USA
E-mail: corcoran@buffalo.edu

The five "postulates"—as opposed to "axioms" or "common notions"—of Euclid's **Elements** [2, volume I, pp. 153–240] are specifically geometrical. The first: *to draw a line from any point to any point*; the fifth: the parallel postulate.

The fourth postulate [2, volume I, p. 200] is:

Kai pasas tas orthas gonias isas allelais einai.
All right angles are equal to one another.

One first-order translation in variable-enhanced English (cf. [4], p. 121) is:

Given two angles *x*, *y*, *if x* is right and *y* is right, *then x* equals *y*.

It is clear to us, as it might have been to Euclid, that the fourth postulate uses *equal* for a relation of angles to angles and not for a property belonging to angles—as intimated by Euclid's *to one another*.

But, De Morgan (1806–1871) did not see it this way, at least in 1831 [1, pp. 203, 206–219]—before he discovered relational logic [3]. Omitting *to one another*, he wrote:

All right angles are equal.

The latter he took as elliptical for:

All right angles are equal magnitudes.

As if emphasizing his construal of Euclid's fourth postulate as an Aristotelian subject-copula-predicate, universal-affirmative, categorical proposition [1, p. 203], he applied an Aristotelian conversion rule to it, deducing the following [1, p. 206]:

Some equal magnitudes are right angles.

We examine these and other historically revealing statements in [1]. Our study establishes a zero base-line reference from which to measure the De Morgan's stunning future progress in logical theory.

[1] AUGUSTUS DE MORGAN, *Study and Difficulties of Mathematics,* Open Court, 1831/1943.
[2] EUCLID, *Elements*, 3 volumes (Thomas Heath, translator), Dover, 1956.
[3] DANIEL MERRILL, *Augustus De Morgan and the Logic of Relations*, Kluwer, 1990.
[4] ALFRED TARSKI, *Introduction to Logic*, Dover, New York, 1995.